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ADDRESS OF PRESIDENT H. K. MORRISON TO THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Gentlemen of the New England Association of Gas Engineers, and our guests: I take great pleasure in welcoming you to this, the 46th annual meeting of our Association.

We meet in the same old room that has sheltered us from the start. We have outgrown it, we have been crowded and uncomfortable, we have suffered for lack of fresh air, we have caught cold from drafts, we have lost largely in efficiency, but here we are at home, and the welcome seems the warmer because of it. Some day, however, this association must instruct its Directors to seek new quarters for its meetings.

This is a fitting time to meet together. We are reviewing another year's work just completed, another record on the books; and planning a new year, with its unknown difficulties and successes. We are here to get an inspiration from the meeting, because the record of this Association in the past gives us the right to expect it. We are here to co-operate, each with the other, whenever such co-operation is needed. We need closer co-operation among our various companies. No one company's interests are independent of its neighbor's, as modern civilization is made up. We need the co-operation of our customers, and that of the regulating bodies of the Federal Government, and of the various Commonwealths. We need to co-operate with every other association that has the welfare of the gas business as its object.

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We are here to broaden our views, as well as to render help to some other whose education or experience may need that help. That has ever been one of the characteristics of this Association in its work, both in its proceedings and the personal contact made possible among its members. It has a broad educational value, and makes it possible to be of assistance in training efficient workmen in the commercial and engineering departments of the industry.

We are here to make friends and learn the value of confidence in business. We are here to take home with us, value for our employers. Large expense is incurred in these meetings, but the investment will return interest with increased efficiency.

The past year has been a difficult one for many of us. Some of the large companies report actual loss in sales for the last year, while others are merely holding their own. Conditions have been forced on us by the greatest calamity of history being enacted in Europe.

Depression in business has been the rule, and it is hard to see how we are to escape our share in the suffering that the whole world must bear. Never before has such a situation existed, and we have no experience by which we may be guided in looking into the future. Commerce is paralyzed; on the water, because of inadequate merchant marine, and on the land, due to the enormous output of munitions for the belligerents. So acute has the condition become that necessities for domestic consumption have been embargoed. We have a right to ask, I believe, why our industry should be crippled and suffer financial losses for the sake of certain other manufacturers who are to reap large profits. A strong protest should go out from this meeting demanding that this condition cease.

Have you any coal? What is the price of oil? These are questions heard whenever gas man meets gas man. Shortage of raw material on the one hand, and other soaring prices for material and labor, mean unknown difficulties for the future. Whatever the outcome of conference on wages between the miners and operators and railroad men, and their employers, it seems inevitable that present conditions will continue for some time so come. Truly, we are "between the devil and the deep sea."

Through all the uncertainty, however, there is plenty of courage and confidence in the stability and growth of our industry, and of its survival.

While this Association has done a wonderful amount of educational work, over its long history at its annual meetings, could it not do much more by organized work throughout the year? In a competitive organization similar to ours, there are some ten or more active committees working for the good of the business they represent, co-operating in many ways and always at it. I have often wondered how so much is done by our Association, and tried to picture how vastly stronger we would become by being tied together throughout the year, so to speak, by some strong working committees. And as one step in the right direction, it would seem that the time is opportune for affiliation with the National association, the American Gas Institute, that central body with international influence and connections. There was a time when such affiliation meant the loss of our identity, and was unthinkable for the oldest American association. Now, however, the Constitution of the A. G. I. has been so revised that there would be nothing lost, and in return we would receive all the benefits of the greater influence and the larger opportunity of the Institute, with its many working committees and possibilities for research work. Our body would also be entitled to representation on the Board of Directors

of the Institute, which would be a mutual help in the work of both. I, therefore, hope the association will adopt the recommendation of its Board of Directors and authorize the execution of the affiliation agreement.

I am also venturing to suggest to the Committee that will nominate the officers for the next year, that they begin the custom of placing one man, at least, from each State on the Board of Directors. The present board is made up of five members from Massachusetts, two from Connecticut and one from New Hampshire. This is not fair representation, and I hope it will not so continue. With the election of the next President and the retirement of one other director, at his own request, the opportunity of including two other States is presented. This will make for closer co-operation.

With the advance in prices of coal, the coke business has made large gains. In many cases stock that has been accumulating for years has disappeared. Continuation of present conditions would seem to point to a shortage of coke, and indicates that prices will remain well above the average of past years.

The demand for explosives in heretofore unheard of quantities, has run the market value of benzol from 20 cents a gallon to four or five times that price, and of toluol from a normal price of 25 cents to $4 to $6 a gallon. This has brought into being some twenty new plants for the recovery of these oils for production of explosives, dyes and other chemical products. The annual capacity of plants for their recovery is stated at twenty million gallons yearly, and undoubtedly when the abnormal demand ceases, there will be serious efforts to continue to market these by-products. Benzol is an excellent motor fuel, and it is certain that manufacturers will endeavor to hold the dye and chemical industries which are making rapid strides forward; and this will benefit some of the larger gas companies. Spent oxide and holder oils are also finding a market, and a fine opportunity is given to clean up the yard at a profit.

From all over New England comes encouraging news, notwithstanding the troubles of the present and competition growing keener year by year:

Maine reports the average growth, compared with 1914. Activities were begun early in the year by the newly formed Commission, which fortunately has a personnel of unusually high character and ability. Their activities were fortunately inaugurated by conference with the various lighting interests of the State. Later a system of uniform accounting, embodying the best points brought out in other States, was adopted and put in charge of an accountant of unusual ability and accuracy.

"Seldom," says Maine, "has the outlook been better for a coming year than at present. With the price of coal as high as it is, a great opportunity presents itself for 1916 for the gas business."

New Hampshire reports normal conditions and normal gains, with nothing special to note during the year. Harmory rules, and the B. T. U. standard works well; but it is said that the average required is set too high for best service to the consumer.

Rhode Island gains in sales were quite as large as in 1914. A large quantity of new work was completed during the year, and much has been laid out for 1916, including one plant of a type new to New England. The relations between the lighting companies and the utility commission have been very friendly.

Connecticut reports an almost invariable increase in output, and somewhat more than the usual gains. Plant additions were not extensive. The two most important happenings in a public way were the adoption by the utilities commission of new rules and regulations for gas; and the imposition of a State tax on gas, electric and water properties, of 1 and 1½% of their gross receipts, and this on top of heavy local taxation. The rules placed in force by the commission cover meter testing, and especially, calorific requirements. The standard applies to all companies whose output is more than 20,000,000 cubic feet per year. Tests must be made on three days each week, to determine the total heating value, and reported monthly to the commission. "The monthly average total heating value shall not be less than 575 B. T. U. per cubic foot, at no time shall the total heating value of the gas be less than 530 B. T. U.'s per cubic foot. This standard seems to work no hardship, as far as ability to maintain it is concerned, but is still too high for the most efficient service to the consumer.

Massachusetts companies did not make the gains of former years. Some have lost largely and are even behind 1913 in actual output. We did not suffer from the enactment of laws, and our relations with the commission have, we believe, grown more friendly and the co-operation closer. We look forward toward the trial of the B. T. U. standard in place of that of candle power, with the hope that it will help us in the cause of better service, and that we will be allowed to try a lower standard on the basis of average results, and that publicity will be considered sufficient penalty.

New England is the home of vertical plants. At this time there are no less than ten works carbonizing coal in the "upright manner." New types are continually finding their way here and being tried out. We can also boast of distributing illuminating gas through more miles of high pressure main than any other district. Pretty good for staid and conservative old New England.

Death has claimed one Honorary Member and one Active Member from our midst during the year 1915.

Col. Charles S. Spaulding was born in Franklin County, Vermont, April 25, 1828, and died in Waltham, Mass., April 28, 1915, in his 88th year.

Benjamin Wilton Perkins was born in London, England, September, 1859, and died in Hartford, Connecticut, February 11, 1916.

Mr. Perkins came to this country when 9 years old, and began in the gas business under his father at South Bend, Indiana. Rising step by step, he became the manager of the South Bend Gas Company and completed a service with that company of about thirty years. Ten years were spent in the management of the Altoona, Pa., Gas Company, and in May, 1910, Mr. Perkins was appointed general manager of the Hartford City Gas Light Company, which position he filled with great credit.

Mr. Perkins was a member of the American Gas Institute, and its first president. He was also a member of the Society of Gas Lighting, of the Elks, and Knights of Pythias, as well as of this Association.

Mr. Perkins' social life was largely of domestic character. He was a devoted husband, a loving father, and was considered one of the most congenial companions that a man could have in the commercial world. His loss will be very much felt in the community in which he lived.

Connecting Electrical Circuits to Underground Pipes.

Contrary to accepted teachings to prevent the carrying of electric currents by water pipes and the dangers from electrolysis where the currents leave the pipes, are the conclusions reached in a paper by Burton McCollum to the Central States Water Works Association. The paper gives data and the theory upon which the conclusions are reached, the latter being stated in brief as follows:

1. Many of the dangers arise from electric circuits may be eliminated by earthing them.

2. For earthing electric circuits water pipes are the most desirable.

3. There is no danger of electrolysis by such stray alternating currents as may result from earthing low voltage alternating circuits.

4. Direct current circuits should be earthed at but one point, preferably at the station.

5. Where conditions permit, two or more ground connections should be made on each secondary system.

6. In a low voltage circuit in which a number of earth connections to pipes are made, they should be confined to one piping system. Measurements of the resistance of the pipe line between the farthest removed points of connections should be made, to make certain there are no insulated joints in the pipe line, which may cause the electric circuit to carry heavy stray currents from railways.

7. In making either single or multiple earth connections to water systems, unless it is positively known that there are no insulating joints near by, the adequacy of the earth connection should be determined by measurement of its resistance. Earth connections should not be made to cement joint lines, or lines in which there are many joints of high resistance.

8. Connection to pipe lines may be made by screwing a brass plug into the bell or by clamping or soldering to service pipes. Soldering is preferable to clamps.

9. Earth connections to service pipes should be made at the point where there is the least likelihood of the pipe being disconnected between the connection and the main. If the water meter comes between connection and main a jumper of the same size as the ground wire should be put around it.

10. Earth connections to gas pipes should be prohibited chiefly on account of the chance of explosions or fires, and also because the almost invariable presence of water pipes makes such connections unnecessary.

11. Because of the great advantage to the public and the slight disadvantage, if any, to public service corporations resulting from earthing to water pipes, such earthing of secondary systems should be made compulsory.

SWISS TESTS OF GAS-FIRES.

[From report by DR. E. OTT in the "Journal für Gasbeleuchtung," of his investigations at the Schlieren Gas Works, Zurich.]

The investigation was of apparatus that acts mainly by convection, and those that act mainly by radiation, because both types have special advantages. The hygienic aspect of the two is not discussed by the author, as he regards it a question to be settled by authorities on hygiene. A satisfactory fire depends primarily on the heating efficiency—*i. e.*, that while the calls upon it vary, it furnishes as much heat as possible, and allows little to escape with the flue gases. There are also other considerations in judging a gas fire, among which may be mentioned that, in normal working, it should allow no products of combustion to escape into the room; that down draught in the chimney should not damp or extinguish the flame; that there should be little opportunity for the settling of dust, which causes a bad smell when the fire is used, that the fire should not light back when the consumption is reduced to one-third of normal; and that it should be well constructed. Special attention was given to the measurment of radiation, because hitherto comparatively few investigations have been made. The rise in temperature at different points in the room was also studied. The fires consumed when fully turned on, 25 to 26.5 cubic feet per hour; the pressure of gas at the burner was 16·10 to 20·10; and the center of the flames in all cases was 12" from the floor.

THE EXPERIMENTAL ROOM.

The room used for the tests was in the basement of the laboratory. On three sides, it had adjacent rooms; on the fourth, or northern side, only the upper half of the wall was exposed. Outdoor influences were excluded by means of double window sash and a rolling shutter. Openings in the wall for the door, pipes, and small window, were closed carefully so as to make the room reasonably independent of weather influences. The plan of the room, which was of about 1765 cubic feet capacity, is shown in Fig. 1.

It was at first intended to make the temperature readings from outside; but it was found more convenient to read the thermometers in the room itself. An observer, therefore, remained in the room while it was warmed up by the fire at full consumption, moving about as little as possible. He made the first set of temperature readings and reducted the rate of consumption when the desired room temperature was attained, and took samples of the air. While this method of taking the temperatures possibly did not give absolutely accurate results, it gave comparative results as the same method was followed in all cases. Practically the same readings were obtained on repetition. When efficiency and radiation measurements only were made, the door and shutter were opened.

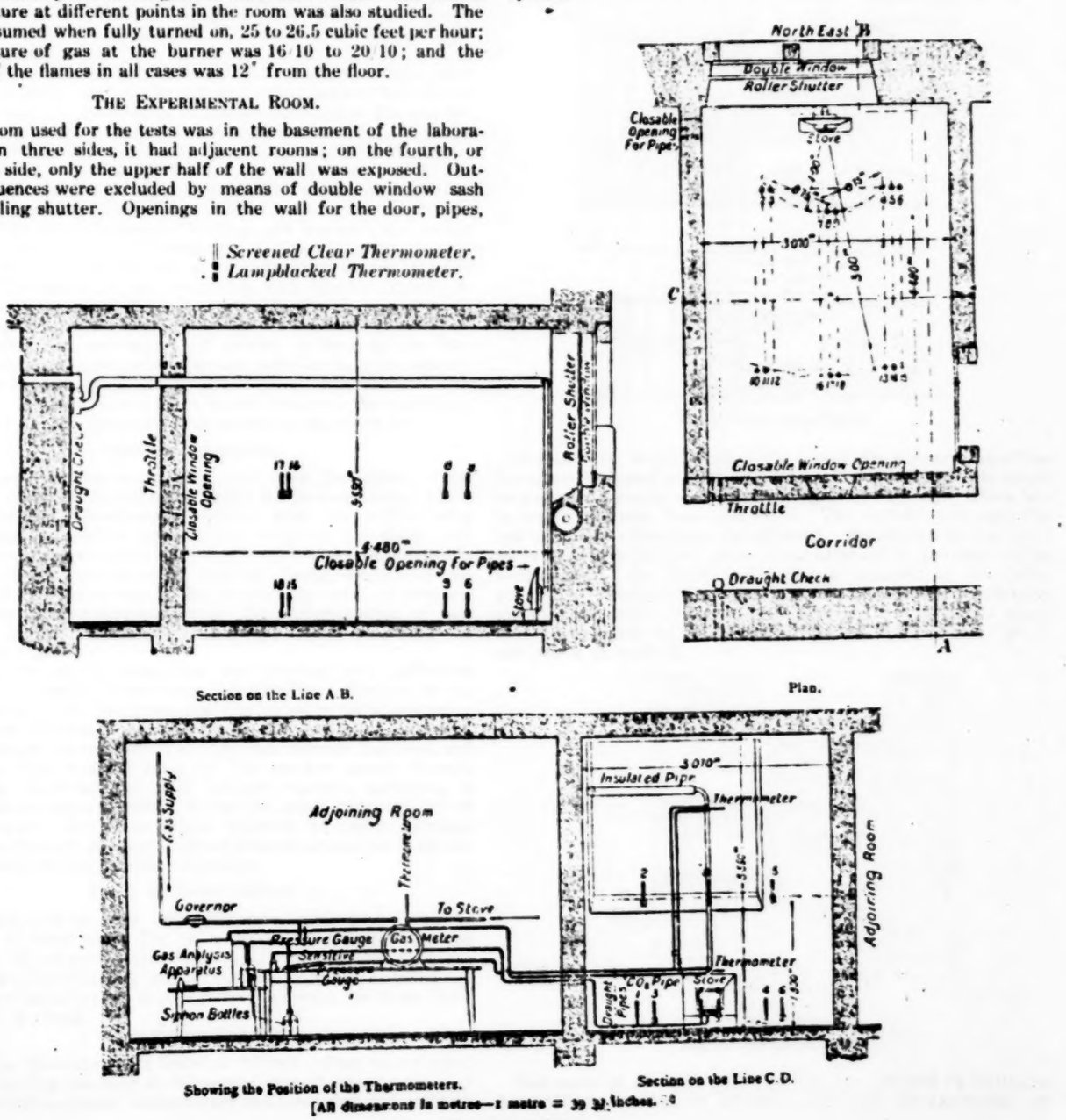

Fig. 1.—Experimental Room.

Efficiency Test.

The efficiency is known to be affected by chimney draught; and in order to test thoroughly for escape of products of combustion, a draught of only 0.04 of an inch of water was allowed in these tests. The immediate removal of the principal current of flue gases was necessary in order that escape of products of combustion might be traced through the detection of carbonic acid. Though using a flue-pipe gave somewhat unfavorable results, they correspond more nearly with actual practice. To ascertain the effect of flue draught on efficiency, other tests were made with a draught of .12 of an inch.

The efficiency was calculated by the simple formula devised by Dr. Bunte:

$$\text{Efficiency percentage} = 100 - 100 \times \frac{a}{b} \times c\,\frac{(t_2 - t_3)}{H_u}, \text{ in which}$$

a = the volume of carbonic acid produced by the combustion of one volume of gas;
b = the percentage of carbonic acid in the hot flue gases;
c = the specific heat of the hot flue gases;
t_2 = the temperature of the flue gases;
t_3 = the temperature in center of the experimental room;
H_u = the net value of the gas in calories per cubic metre at 0 C. and 760 mm.

The carbonic acid in the flue gases was generally only determined directly, about 12 inches from the gas fire--as samples taken at the exit from the room gave practically the same results. The flue gases for testing were sucked into an adjoining room and analyzed with an Orsat apparatus, but as the temperature of the flue gases decreases very rapidly as the distance from the fire increases, it was observed both at the flue vent from the fire and at the flue exit from the room, about 10' from the floor. Ordinary chemical thermometers were used. While ordinarily it is sufficient to use a mean value for the carbonic acid produced on combustion and the calorific power of the gas, in the present case the carbonic acid produced on combustion was determined for the extreme calorific values by the combustion of 100 c.c. of the gas over copper oxide; and the calorific power was ascertained by means of a standardized automatic Junkers calorimeter.

For calculating the carbonic acid in the hot flue gases containing all the water vapor produced by combustion, it was assumed that about two volumes of aqueous vapor are formed with one volume of carbonic acid. The proportions of carbonic acid stated in the sequel are not the direct readings of the Orsat apparatus, but refer to the hot humid flue gases. The mean specific heat of the latter was assumed to be 0.32. Those fires provided with an anti-back-draught device were tested both with and without it, in order to ascertain its effect on efficiency. The efficiency of all the fires was ascertained both, when burning at the maximum normal rate of consumption and at about half rate.

Radiation.

The radiation was measured by a water calorimeter on the principle of that used in the laboratory of the United Gas Improvement Company. The instrument consists of a casing of sheet copper 0.035' in thickness, having the shape of an arch 2 metres (79.7") in span, bounded by two meridians 20° apart, making the inner surface of the arch one-eighteenth of the surface of a sphere 2 meters in diameter. The two surfaces of the case are 3 mm. (0.12 inch) apart, the narrow space thus provided holds only a little water, and hence a condition of equilibrium is attained after a few minutes. In order to ensure thorough mixing of the water, the space is divided by baffles lightly attached to the copper plates, which allow some water to take the shortest passage, and thus dead angle spaces are avoided. The inner surface of the vessel, that facing the stove, is blackened, the back is polished, and enclosed by another polished copper plate, 0.024" thick, which forms an air jacket. This third plate is not attached to the others by conducting material, and hence does not take heat from them.

The vessel can be brought to any desired position by means of a cord and pulley. The water enters at both ends, and flows out in the middle at the top, where its increase of temperature is measured by thermometers graduated to 1-tenth of a degree C. A constant head overflow ensures a uniform inflow of water, so that practically the same quantities of water were used for all the tests. The temperature of the air was determined by three thermometers attached to the back of the apparatus, and the temperature of the inflowing water was regulated so that the mean of the three thermometer readings agreed approximately with the mean of the inlet and outlet water temperatures. This was easily effected by regulating the air temperature by opening the door and window ventilators. Care was taken, however, to avoid draught; the smoke of fumigating pastilles rose vertically and not towards the calorimeter. The effect of convection on the measurements was excluded as far as possible, and the calorimeter records substantially only the radiation of the fire. The apparatus is shown in Fig. 2.

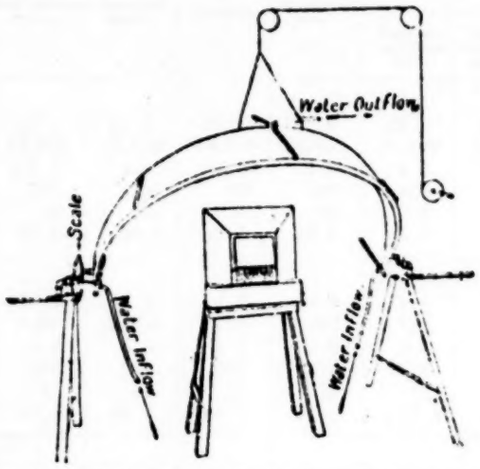

Fig. 2.—Radiation Calorimeter for Domestic Gas Stoves.

This method occupies only half the time of that adopted by the [? Carlsruhe] Institute, by which radiation and convection are determined together, and then the effect of convection alone by cutting off the radiation by means of a copper screen. The method adopted at Zürich also appears to be more exact, as it is extremely probably that the screen cuts off more or less of the convection as well as the radiation. The radiation in the upper 30° cannot be measured by this method, owing to the upward convection currents, but this upward radiation is of comparatively little importance, both on account of its amount and direction. With many fires it would probably be less than the radiation from the back, reflected from the wall, and which has never been properly determined. The radiation for the bottom 30° was excluded, and the radiation was therefore determined at the six angles of 20°, shown by shaded lines in Fig. 3.

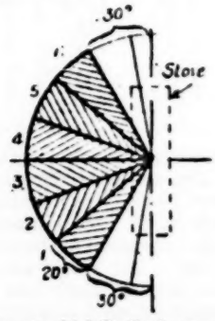

Fig. 3—Angles at which Radiation was Measured.

In order to obtain rises of temperature large enough to avoid errors, the fires were tested at full consumption, and when the consumption was reduced to half, tests showed the radiation was in about the same ratio.

After conditions of equilibrum were attained five minute measurement were made, collecting the warm water flowing from the calorimeter and taking readings at intervals of a minute of all the thermometers. The rise of the temperature of the water when about 3 litres were passing in five minutes—the calorimeter holding about 2 litres—was never less shan 0.2° C., or more than 6.5°.

The heat radiated was calculated from the temperature rise, and expressed as a percentage of the heat of the gas consumed in the same time.

Distribution of Temperature.

The distribution of temperature was ascertained by thermometers hung at different heights and at different distances from the fire, and in order to ascertain the temperature of the air, as well as the effect of radiation, some of the thermometer bulbs were protected with rolls of silver foil and others were blackened. Twelve

thermometers were distributed in two circles with radii of 1 and 3 metres (39.3 and 117.9 inches), with the bulbs one-fifth of an inch from the floor. They were arranged in six pairs — one with polished screen and one with blackened bulb in each pair. There were also six theremometers with polished screens with the bulbs, 1.5 metres (59") from the floor, exactly over the middle line between each pair at the floor level. The locations are shown in Fig. 1. An unblackened thermometer was suspended in the middle of the room to register the average temperature of the room.

The thermometers were read in the closed room before each test, to assure that there was equilibrium of temperature conditions. The fire was then lighted and kept burning at full consumption for 55 minutes, when the observer in the room took temperature readings. The fire was checked to half consumption five minutes later, and a sample of air taken from the middle of the room. The observer then left the room; and the continuous heating test, extending over three hours, started. Two hours and 55 minutes later all the temperatures were again observed, and a sample of air taken. Five minutes after the last set of observations, the fire was turned out. Temperature readings were made during the next three hours to ascertain the rate of cooling, and air samples to get data on the renewal of the air. The door was left open slightly during the night, so as to bring about the state of equilibrium necessary for another test on the following day. The temperature of the outer air was observed throughout, and weather conditions noted. All tests were repeated three times, and the mean results given in the report.

The temperature distribution tests involve much more detail than those for radiation, and require care and quiet weather, but the results show that the distribution of temperature that a fire may be expected to give can be deduced with sufficient accuracy from its radiation. With the exception of Type V, the temperature distribution tests were made without the stove being connected to the chimney, and with the throttle-valve in the passage closed. The 100% efficiency thus attained was adopted in order to exclude differences in the heat efficiencies of the fires, and thus make the results solely dependent on its heat distributing qualities. Comparative experiments with chimney draught did not show any appreciable differences. The radiation tests were made with chimney draught, in order to avoid the effect of hot currents of effluent gas. But in this case also the results were stated as a percentage of the total energy applied, and not merely of energy utilized by the fire. This procedure was permissible, because radiation is much less affected than room temperature by the method of removal of the flue gases. It depends, to a much larger extent, on the concentration of heat and the temperature of certain parts of the fire.

Hygienic Conditions.

The air near the fires having flues, and from the middle of the room, was tested for carbonic acid with a Haldane apparatus, which admits of smaller proportions of carbonic acid than 0.01% being read, fumigating pastilles detected any escape of flue gases; and for fire flames comparatively wide apart—which are objectionable on account of the uncertainty in lighting—faulty removal of the products of combustion may be detected by the smell of escaping gas when one burner is extinguished. The determination of carbonic acid, however, is the only trustworthy way of determing the escape of flue gases.

The completeness of combustion was checked with palladium chloride. In order to obtain some quantitative indication of the carbonic oxide in the flue gases, the very sensitive palladium paper was not used, because it indicates traces that are quite harmless. A dilute bright yellow solution of palladium chloride was used, and it has been found that if 5 litres of flue gas are passed through about 70 cc. of the solution, with frequent vigorous agitation, in 4 hours, discoloration is evident if the flue gases contain 0.1% of carbonic oxide. This proportion is injurious to health, although even if considerable escapes it will not raise the proportion in the air of the room to 0.05%, which is harmless.

Types of Fires Tested.

Five types of stove were tested, in some cases under two or more sets of conditions The types were: (1) Convection stove (Fig. 4); (2) reflector stove (Fig. 5); (3) gas radiator (Fig 6); (4) radiation fire (Fig. 7); and (5) that shown in Fig. 8, which can be used as a radiation fire or as a convection stove, the front doors being open or closed.

Methods of Testing.

In general the stoves were tested as follows: They were lighted and kept burning one hour at full normal rate of consumption, and some observations made. Temperature measurements and carbonic acid were made at the flue exit from the stove and at the point where the flue pipe passed out of the room. In most cases these were made with the draught at the stove regulated to 0.04" of water and to 0.12". Those stoves having an anti-down-draught device were tested with the device out of action and in action. After the first hour, the stove was turned down to the rate of consumption intended after the initial warming of the room, and was kept at this rate for two or three hours. The observations were then repeated at the reduced rate of consumption, with 0.04" draught.

Radiation observations were made at full consumption and with 0.04" draught.

Observations to determine the distribution of temperature in the room were made on the 18 thermometers shown by the numbers in Fig. 1. Readings were taken after one hour's burning at fuel consumption, and after a further one hour's burning at the reduced consumption, and again after another hour at the reduced consumption. The gas was then turned out and readings made at intervals of an hour, to observe the rate of cooling at different parts of the room.

The results are given in the table.

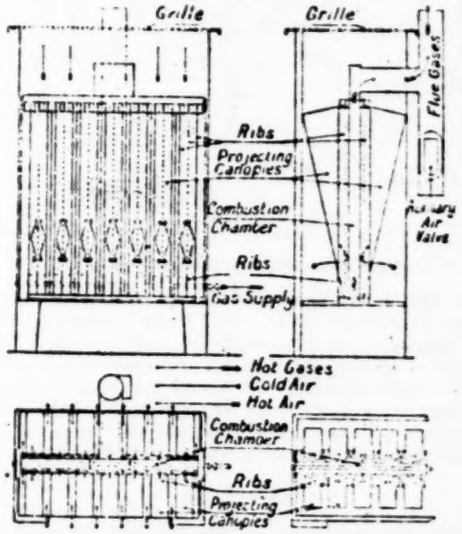

Fig. 4—Convection Stove.

In this stove, as with most of the others, the temperature of the flue gases increased with the draught, although the reverse might be expected, because of more air being drawn through. There was no escape of gases from this stove. The anti-down-draught flap had very little effect upon the efficiency; the reduced proportion of carbonic acid in the flue gases being balanced by the lower efflux temperature. The ventilating action is increased by this device and also by increased flue draught. The differences in efficiency of this stove under different conditions are comparatively small. The radiation was very small, being greatest at the angles 1 and 5, and lowest at angle 3.

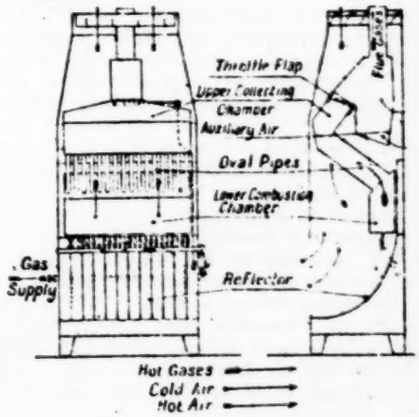

Fig. 5.—Reflector Stove.

This stove is of light construction, and attained its maximum heat in three-quarters of an hour; and with the gas turned off,

Results of Test of Five Types of Gas Stoves, with Flue Draught of 0.04" of Water.

Rates of consumption and calorific values in cubic feet at 60° F. 30" pressure and saturated. The net calorific value of the gas was 487 to 579 B. T. U. One volume of gas produced on combustion, 0.480 to 0.495 volume of carbonic acid.

Type of Stove.	Convection Stove.	Reflector Stove	Radiator.	Radiation Fire.	Radiation or Convection Fire.	
					Used as Radiation Fire.	Used as Convection Stove.
Test at full consumption:						
Rate, cubic feet per hour	26.7	26.6	27.1	27.9	27.9	27.0
B. T. U. input per hour (net calorific power multiplied by rate)	13,380	13,170	14,078	14,047	14,166	13,650
Carbonic acid in hot humid flue gases, per cent	6.5	4.8	6.15	4.9	4.4	4.2
Temperature of gases at flue vent, degrees F	280	415	300	340	426	460
" " " air in centre of room	84	70	81	75	75	72
Efficiency (utilized percentage of B. T. U. input)	94.6	87.0	93.7	90.3	85.7	83.5
Continuation of test with consumption reduced:						
Rate, cubic feet per hour	16.3	14.2	13.9	15.4	13.4	13.0
B. T. U. per input hour	8,384	7,023	7,198	7,769	6,821	6,555
Carbonic acid in hot humid flue gases, per cent	4.0	3.5	3.5	2.85	3.1	2.45
Temperature of gases at flue vent, degrees F	232	248	250	275	376	360
" " " air in middle of room	81	66	79	73	72	68
Efficiency (utilized percentage of B. T. U.)	93.3	89.4	91.3	87.3	82.4	78.7
Tests at full consumption:						
Radiation measured per cent. of energy (B. T. U. net) input	1.48	8.61	19.68	29.14	19.19	3.65
Rise of thermometers in different parts of room (see Fig. 1) in one hour from lighting of fire, at rate of consumption stated:						
Cubic feet per hour	26.9	27.9	27.4	27.7	27.9	27.7
Thermometer No. 1 (lampblacked) degrees F	2.9	4.1	8.3	10.3	9.0	3.8
" " 2 (clear)	14.9	12.4	14.2	13.5	13.0	13.1
" " 3 "	2.7	3.6	6.1	8.6	7.0	3.2
" " 4 (lampblacked)	2.7	4.1	9.0	13.0	10.1	3.4
" " 5 (clear)	15.3	12.8	13.3	13.9	14.0	13.7
" " 6 "	2.3	3.1	6.1	8.5	6.8	10.8
" " 7 (lampblacked)	2.9	6.8	9.2	16.7	13.9	4.1
" " 8 (clear)	15.7	13.0	14.0	15.1	15.1	13.7
" " 9 "	2.5	5.2	6.1	10.3	7.2	2.7
" " 10 "	2.2	2.3	3.1	4.3	3.6	2.2
" " 11 "	15.3	11.9	11.5	11.9	11.5	12.8
" " 12 (lampblacked)	2.2	2.3	3.6	4.7	4.1	2.2
" " 13 (clear)	2.0	2.2	3.1	4.1	3.6	2.0
" " 14 "	15.5	11.9	11.7	12.4	11.7	12.8
" " 15 (lampblacked)	2.2	2.3	3.8	5.2	3.6	2.0
" " 16 "	2.0	2.0	3.1	4.5	3.4	2.0
" " 17 (clear)	14.9	12.1	11.2	12.2	11.7	12.8
" " 18 "	2.2	2.2	2.9	4.0	3.1	2.0

cooled down in about the same time. The burning orifices were close enough together for the flames to light one from the other. They were luminous, but could only be seen with difficulty through a lateral window. There was no smell of gas in the room when the flames was extinguished and the gas left turned on. The flue gases were free from carbon monoxide. Stopping the flue draught made the full size flames flicker; but this was cured by replacing the flap valve by a simple opening. The hot surfaces of the stove being nearly vertical, did not collect dust; and the temperature in the upper part of the stove did not exceed 300° F. at full consumption, or 410° F. at the reduced consumption. The outer parts of the stove remained almost cold; hence the low radiation. It was built of aluminum (hence the rapid exchange of heat) and was a very good example of the pure convection stove.

With the Reflector stove there was some escape of flue gases, reduced when the draught was increased; and the temperature of the escaping flue gases showed considerable increase when the draught was increased. The opening of the anti-down-draught device also increased the temperature of the flue gases. Neither this device, nor reduction of rate of consumption, nor small increase in the flue draught, had any appreciable effect on the efficiency. The radiation was fairly uniformly distributed; being highest at angle 2 and lowest at angle 6.

This stove, also, owing to its light construction, attained full heat in about 40 minutes; and when the gas was turned out cooled down in less than an hour. The action of the reflector caused an increase in the radiation compared with the convection stove, and, there was lower temperature of the air at the breathing level. Both with the flue draught of 0.04 and 0.12" there was some escape of flue gases into the room, and a smell of gas when the flames were blown out. This could be overcome by raising the position of the burners and widening the flue exit. The flue gases were free from carbon monoxide. The inclined oval heating tubes attained a temperature exceeding 400° F. at full consumption, and exceeding 210° F. at reduced consumption; the temperature of the escaping air in the first case being 230°. All parts of the stove were readily accessible; and, though it was of light construction, it was strong enough. It was a typical reflector stove.

With the Radiator, Fig. 6, neither the anti-down-draught device, nor increase in flue draught, nor reduction in the rate of consumption had much effect on the efficiency. The radiation was fairly high, owing to the luminous flames, and to the dull metal parts being at a high temperature. It was fairly uniformly distributed—greatest at angles 1, 2 and 3, and lowest at angle 6. Owing to its heavy construction, the radiator took an hour to heat up to its full temperature, and more than an hour to cool down. The effect of radiation on the thermometers was quite marked; and the temperature of the air at the breathing level was correspondingly lower. The burners, being batswing or slit burners, could be turned down.

With the anti-down-draught device open, there was no appreciable escape of flue gases. Interruption of the draught when the burners were on full caused a tendency to smoke, and to form carbonic oxide. At full consumption the temperature of the lower communication tube exceeded 570° F.; that of the upper tube being about 210° F. At reduced consumption the corresponding temperatures were about 446° and 185°. The temperature of the air between the columns of the radiator when at full consumption was about 194° F., and the air directly above the radiator 176° F. The hot surfaces, being vertical and easily accessible, can be readily

kept clean. The radiator was of cast iron, and intended for office use, etc. Because of its good radiation and convection results, it is a good intermediate type between the radiation and the convection stoves.

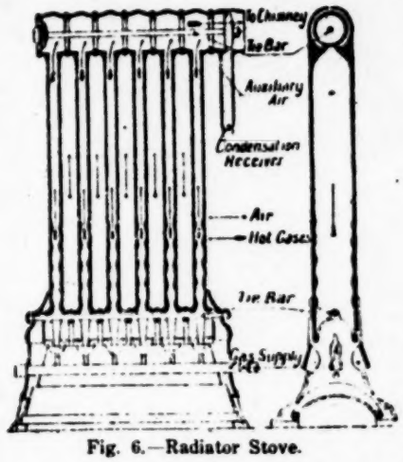

Fig. 6.—Radiator Stove.

The Radiation fire had no anti-down-draught device. Reducing the rate of consumption greatly affected its efficiency, owing to the poor transmission of heat through the heavy stove. The difference in efficiency at the flue outlet and at the outlet of the flue pipe from the room, was considerable. The radiation, amounting to 29.14% of the heat supplied, was highest at angles 3 and 4, and lowest at angle 1. The upright fuel columns gave the highest radiation horizontally. This fire also, on account of its heavy construction, needed about an hour to reach full temperature, and about an hour to cool again. The effect of the radiant heat on the thermometers was large, naturally. The burners being of the atmospheric type, the rate of consumption could not be much reduced without risk of back firing. There was no air adjustment to the burners. The flames lit one from another. Flue gas escaped into the room, especially before the fire got fully hot, both at 0.04 and 0.12" draught. With the flue unobstructed, there was no carbonic oxide in the flue gases. Down draught in the chimney did not extinguish or affect the flames. Some parts of the stove were very hot; the air above the center of the back plate was above 480° F. at full consumption, and at reduced rate, about 300° F. The surfaces of the stove, being merely vertical, collected little dust; it is of solid construction, and the fuel columns are durable. It is a true radiant gas fire.

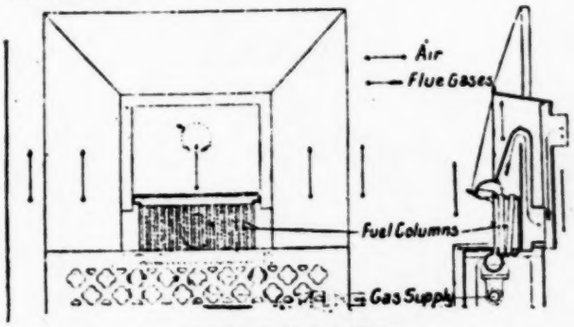

Fig. 7.—Radiation Fire.

The stove shown in Fig. has doors which convert it from a radiation to a convection stove. Tests were made with the doors open for radiation, and with the doors closed, converted it into a convection stove. The investigations were made to follow the distribution of temperature with full and with reduced radiation with the same stove; and the results are not altogether comparable with the figures for the other types. Owing to considerable escape of flue gases, the efficiency could only be determined approximately.

With the doors open, the temperature of the flue gases at the vent was high; and hence the efficiency appears low. Reduction of the rate of consumption greatly affected efficiency. The radiation, totaling 19.19%, was greatest at angles 3 and 4, and lowest at angle 1 (see Fig. 3). It attained its full heat in about 50 minutes; and after the gas was turned off took about the same time to cool. The four Méker type burners, being wide apart, did not light from each other, but could be turned down without flashing back. There was considerable escape of the flue gases into the room, the proportion of carbonic acid in the air in the neighborhood of the fuel columns being 100 volumes per 10,000, even at reduced consumption; and in the air of the room 25 volumes per 10,000 at full consumption, and 15 volumes at reduced consumption. The flue vent should therefore be improved. Carbonic oxide was not detected, and the flame burned steadily, even with the flue draught checked. The temperature of the metal at the flue exit was 570° F. at full consumption, and 390° F. at reduced consumption.

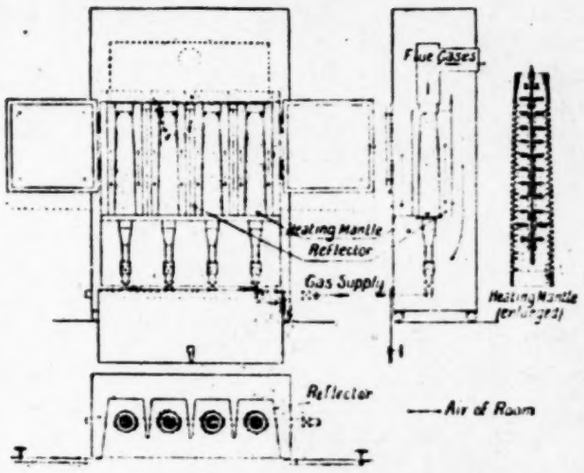

Fig. 8.—Radiation or Convection Stove.

With the doors shut the efficiency was lower than with them open; total radiation was 3.65%—being highest at angle 1 and lowest at angle 4. The low efficiency was apparently due to increased flue gas temperature, owing to less cooling by air, and to a lower proportion of air in the flue gases, probably because the escape of carbonic acid into the room was greater than when the doors were open. The escape of flue gases into the room could probably be avoided by shortening the fuel columns and enlarging the flue vent.

Conclusion.

It may be noted that the rate of cooling of the rooms showed that rise of temperature from radiation falls away much more slowly after the gas is turned off, than corresponding temperature produced chiefly by convection, due to heavier construction of these stoves and to higher floor and wall temperature.

The more a stove heats by radiation, the quicker warmth is felt, and the more slowly the temperature falls after it is turned out. Though good radiation produces considerable higher floor temperatures in the neighborhood of the fire than convection, there is not much reduction in the temperature at the breathing level. Moreover, a radiation fire of lower efficiency heats more satisfactorially than a convection stove with high efficiency, owing to the better distribution of temperatures. With a very large fire, the radiation close by becomes troublesome, and the scope of the two chief types may be stated as follows: The radiation fire is better suited for small rooms, or rooms heated only occasionally, while the convection stove is suitable for large rooms, or for continuous heating.

The efficiency of the fires, with the exception of Type V., both at full and reduced consumption, with the flue draught of 0.04", generally exceed 90% at the flue-vent.

Some attention should be given the better removal of the flue gases in the radiation type, although the proportion of carbonic acid in the middle of the room never exceeded 40 parts per 10,000 during the first hour at full consumption, or 30 parts per 10,000 during subsequent heating at reduced consumption; whereas even 100 volumes per 10,000 are not injurous. One hour after the gas was turned off the proportion of carbonic acid fell to 10 volumes per 10,000. These observations support the contention that a certain equilibrium in the composition of the air is established in closed rooms, owing to the renewal of the air through walls and cracks. No stove, even with the flue cut off, produced carbonic oxide enough to render the air of the room injurious to the health.

Finally, the satisfactory behavior of a gas stove is largely dependent on its being of suitable size for the room and the temperature required, as well as on its being properly connected and cared for.—[Illustrations from London "Journal."]

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NEW YORK, MONDAY, FEBRUARY 28, 1916.

Value of Engineering Society Membership.

One value of membership in Engineering Societies was pointedly demonstrated recently by the experience of a member of the Illuminating Engineering Society.

The authorities of a city, where the Gas Company has been an active, progressive competitor for street lighting, had a fine system in operation, were stirred to anxiety as to the illumination being given them. This company's engineer offered to assist the city fathers, and furnished them with numerous papers giving descriptions of portable photometers, test plates, methods of measurement, etc., in fact all of the things they thought they might have to fight to get.

The effect of this I. E. S. data and the attitude of the company had a most salutary effect, and the authorities became so interested in theoretical considerations that they have lost sight of their supposed grievances.

The lesson for companies is to have your operators know; the way to keep them up to the minute is to have them members of the Engineering Associations.

Veteran Meter Maker Dead.

Mr. John McIlhenny, founder of the firm of Helme & McIlhenny, died at his home in Germantown, Philadelphia, on February 23rd, in his 86th year.

In the early days of the manufacture of illuminating gas, Mr. McIlhenny was constructing engineer for the firm of Perdicaris & Hoy, of Philadelphia, and erected several gas plants in the South. He also operated the plant at Columbus, Ga., and while living there took an active part, as Mayer of the city, in restoring order after the close of the Civil War.

Prior to the war there were no public schools in Georgia, and Mr. McIlhenny and his wife, seeing the necessity of public education, drew the bills establishing the public school system of that State. Although Mr. McIlhenny has not lived in Georgia for 40 years, an industrial school in Columbus was this winter named "the "McIlhenny School," in recognition of his services for the children of that city.

In 1876 he returned to Philadelphia and became a member of the firm of Helme & McIlhenny, manufacturers of meters and gas appliances, and of which firm he was the senior partner at the time of his death.

He was for many years a director of the Washington Gas Light Co., Washington, D. C.

Mr. McIlhenny all his life took an active interest in philanthropic and civic work. By cleaning up the city of Columbus and using oil on the surrounding pools he did away with mosquitoes, so that the city invited yellow fever refugees there at the time of the epidemic of 1873. In a cotton mill, of which he was owner, he established the first 10 hour day in Georgia, and in Philadelphia he was one of the first manufacturers to give the Saturday half-holiday to employees.

He was President of the Board of Trustees of the Second Presbyterian Church in Germantown.

He is survived by five children, Mrs H. S. Prentiss Nicholas, Miss Georgia B. McIlhenny, Miss Selina B. McIlheny, John D. and Francis S. McIlhenny.

Pennsylvania Association Meeting.

The eighth annual meeting of the Pennsylvania Gas Association will be held at Easton, April 12th, 13th and 14th. The meeting this year promises to be one of the largest gatherings the Association has ever had, as Easton is one of the most interesting industrial centers of Eastern Pennsylvania, and because of its central location, it is easy of access.

Some interesting papers will be presented, and men prominent in affairs pertaining to the industry, will address the meeting. Full announcement of program will be made shortly. Requests for reservation may be addressed to Mr. E. G. Holzer, Chairman of Entertainment Committee, Easton, Pa.

Illinois Gas Association.

OFFICE OF THE SECRETARY,
OAK PARK, ILLS.

The Twelfth Annual Meeting of the Illinois Gas Association will be held in Chicago, March 22d and 23d, 1916. The papers will be divided into four classes: General, Manufacturing, Distribution and Commercial.

Headquarters will be at the Hotel Sherman, and a very interesting and instructive program has been prepared, as you will note from the list of papers obtained by the Technical Committee:

"Gratuitous Work in the Gas Business," by Albert L. Tossell.
"Constructive Advertising," by John W. Lansley.
"Some Fundamentals Affecting the Utilization of Gas Oil in Carburetted Water Gas Manufacture," by R. C. Downing.
"Disposal of Gas House Wastes," by Paul Hansen.
"Stores Accounting," by William A. Sauer.
"Solicitors and House Record Cards-Methods of Checking," by E. D. V. Dickey.
"The Efficient Use of Gas in the Home," by W. H. Forbes.
"Industrial Welfare Work," by S. H. Moore.
"Functions of Trade Journals," by Milt Saul.
"Investigations of Bunsen Gas Burner Design and Operation," by G. C. Carnahan.

We will have reports from the various committees—Public Relations, Rates, Affiliation, Gas Engineering, etc.

The Entertainment Committee has selected Thursday evening, March 23rd, for the banquet, which will be held at the Hotel Sherman. The price of banquet tickets will be $3, instead of $5, and an extra good banquet and program are promised. Mr. H. M. Byllesby will be our toastmaster; Rev. Dr. F. W. Gunsaulus will talk on "The Latest Mastery of Light," and Mr. W. E. McKay, President of the American Gas Institute, will speak. The vaudeville will be omitted this year, but other unique features will be added.

We are constantly striving to make this Association of greater value and assistance to gas men. To broaden our field we should have every gas man in the State as a member of the Association. We now have 400 members, but will fall short of the 500 mark unless we have your valuable assistance,

HORACE H. CLARK, Secretary

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.

Gas Distribution Section Meeting, Yonkers.

The Elks Club, Yonkers, N. Y., on February 11, was the stage setting for the largest sectional meeting of the season of the Empire State Gas and Electric Association, R. M. Kellogg, chairman of the Gas Distribution Committee, presiding. Yonkers' M. D., Doctor of Laws, Bank Director and Gas Man, Dr. B. W. Stillwell, Vice-President of the Westchester Lighting Co., welcomed the gathering in a manner befitting the occasion, and immediately all present were requested to go to a nearby "movie" house to see the latest U. G. I. film "First Aid for Persons Overcome by Gas." First Aid kits of three styles were shown, Regular, Pocket Size and Belt. The method of assistance in each of three types of cases, the subject dizzy, prostrate but breathing and not breathing, were enacted.

Upon returning to the meeting room the film was discussed, the principal question being the relative merits of certain types of apparatus for artificial respiration. The result was a draw.

Chairman R. M. Kellogg, assisted by Secretary C. W. Wittington, then opened the formal program, calling upon Mr. S. C. Singer, of Syracuse, to begin the topical discussion Electrolysis. The Bureau of Standards technologic paper, No. 52, and articles by Prof. A. F. Ganz were cited as authorities, and thorough bonding of the tracks carrying the return, with no connection to the gas system, which latter should have some insulated joints, were given as the methods of mitigating if not eliminating the trouble. In the discussion it was said that it would be a paying proposition for the trolley company to see that practically all of the "Juice" came home: Drawings were shown of a cement joint finished with rattan between bell and spigot which has been found to be an excellent insulator; also a ¼" fibre insulating joint.

A method of installing a permanent electrolysis test station was described as follows: Main is tapped at two points 10 feet apart, no joints intervening, and ¾" brass plugs inserted. A No. 10 wire is soldered to each of the plugs and run to a curb box. A millivolt meter connected to the terminals will show drop in voltage through 10 feet of main, which can be shown in Amperes by using the factors given in this table:

Current Flow Factors.

Per Millivolt Drop per Foot.

A.G.I. Standard C. I.		W. I.		Steel	
Size.	Amperes.	Size.	Amperes.	Size.	Amperes.
4"	12.0	3"	41.7	3"	35.9
6	19.0	4	58.8	4	50.8
8	26.4	6	104.0	6	89.4
10	35.5	8	156.0	8	134.0
12	46.6	12	371.0	10	234.0
16	70.9	..	.....	..	.....
20	97.1	..	.....	..	.....

The question was asked if any one knew of a paint or other protection for steel pipe. None of the answers were in the affirmative. It was also disclosed that service pipes were still being painted, though no one present would stand sponsor for the value of the practice. The discussion then veered off into freezing, and one company stated that they protected services across areaways by enlarging them and by wrapping in tarred paper, then placing in a ½" jacket of concrete. Another said that the same results could be obtained by increasing the size of the service without covering it, provided the increase was made far enough back to insure warm gas from the main. As far as condensation in meters was concerned, it was said that the meter was the best condenser you could get, and that unless it were placed in a warm cellar, and with house pipes dripped, the troubles here would be worse than from freezing.

The next hour or so was pleasantly spent in "Hob-Nobbing" and at luncheon. Mr. Dan C. Nolan, of the "Yonkers Daily News," Exalted Ruler of the Elks, proved to be an entertainer of higher calibre than is generally found in the professional ranks, to judge from the laughter during his "After-luncheon" talk.

Afternoon Session.

"Inspection of Appliances" was the first topic for the afternoon session, being opened by Mr. V. C. Hoddick, Rochester. Their practice is to have every new appliance that is set inspected by a woman demonstrator. A general inspection is made during the winter by nine men who are engaged in regular shop work in the summer.

It was said that the greatest asset a company had was satisfied employees, and that this inspection work was provided; primarily, so that the shop force could be kept intact the year around. One company inspects all material upon arrival and again before it leaves the shop. Another company inspects rental ranges once a year, but others only on complaint. One uses a unique plan, whereby the salesman-fitters profit by increases in business. There is one man to every 1,500 consumers, paid $15 per week, plus 10 per cent per 1,000 increased consumption. These men have phones in their homes and work nights as well as days. They average about $85 per month. Some companies inspect hotel and industrial appliances regularly, no charge being made.

The final topic, "Consumers' Meters," was opened by Mr. G. A. Saunders, of Yonkers. Some of his axims for good meter service were as follows: Upon arrival meters should have a prover test. They should be delivered to the job "right side up with care." When carried in vehicles they should be placed in bags and on racks. When carried by hand, they should be strapped on the fitter's back. They should be properly located, as otherwise there will be trouble from condensation, etc. The meter should not be made a drip for the house pipes, as was apparently advocated in recent literature of the N. C. G. A. Meter connections should be all iron, with double swing, screw and swivel to face up, so that they can be made up by hand; supporting shelf to be used. Tests should be made on districts, for leaks and registration. The losses from slow meters are larger than is generally supposed, as the percentage figures do not give a correct idea of the quantity. He recommended regular testing on consumers premises, to insure a smaller loss through unaccounted for gas. In the discussion it was brought out that if iron connections were used, no shelves would be necessary. Also that the location of the meter had a great influence upon the unaccounted for gas. A small-flame test on the 2-foot dial would not show trouble from a broken index. Most companies found air as good as gas for testing. A general discussion as to the merits of dipping meters, then followed, and as none of its advocates were present, it was more like a meeting of protest. In answer to the request for information on cast iron meters, it was found that one company was making a test of them.

Among the 90 men present were: Stuart Wilder, H. H. Greenfield, G. T. Macbeth, E. S. Bellows, J. J. Beisiegel, F. A. Schobel, S. C. Hunter, A. H. Vail, W. L. Secord, C. H. B. Chapin, Frank Hellen, E. H. Schmidt, C. H. Stone, W. L. Bruce, J. B. Hare, A. C. Lord, H. A. Hayward, H. W. Terry, Jr., V. von Starzenski, W. P. Hutchinson.

A noteworthy feature of the attendance was that there were 24 member companies represented, and those present were for the most part actively engaged in the particular work discussed.

DETAILS OF BALTIMORE'S GAS RATE SCHEDULES.

The new schedules of gas rates approved by the Public Service Commission of Maryland, for the Consolidated Gas, Electric Light and Power Company, of Baltimore, are comprised in the following supplements to the Commissions previous rulings.

SCHEDULE C.—YEARLY CONTRACT GENERAL GAS RATES.

Gas for any purpose will be sold under this Schedule, upon application, to any customer who has signed an agreement for yearly gas service, embodying the usual terms and conditions now or hereafter in force.

Primary Rates.—Eighty-five cents (85c.) gross per 1,000 cubic feet, seventy-five cents (75c.) net when bills are paid on or before the last discount day.

Secondary Rates.—Forty-five cents (45c.) gross per 1,000 cubic feet, thirty-five cents (35c.) net when bills are paid on or before the last discount day.

This rate will apply to all gas used per month in excess of the amount hereinafter specified as the primary rating, and only to such excess. The primary rating is the number of cubic feet per month which must be used at the primary rate before the secondary rate applies.

The primary rating under this Schedule will be placed at the number of thousands of cubic feet corresponding most nearly to one hundred and fifty (150) times the customer's demand, the demand being defined as the maximum hourly rate of consumption in cubic feet. This is equivalent to one hundred and fifty (150) hours' use of the demand per month, figured to the nearest number of even thousands of cubic feet. The primary rating shall remain fixed, and a fixed element in billing, so long as the customer's conditions of maximum rate of use do not increase, but shall in no event be taken at less than 4,000 cubic feet per month (three dollars—$3 net).

Demand.—The demand is the maximum rate of use by the customer, and is defined as the greatest number of cubic feet used in any one hour. It may be specified in the contract and estimated by the company from the burner rating or otherwise, and may be redetermined from time to time, according to the customer's normal use of gas. The demand shall not be substantially decreased during any twelve-month term of the contract, but shall be increased in accordance with and for all billing after any increase in maximum use which may from time to time occur. The primary rating will be changed accordingly. Upon extraordinary occasions for a certain limited period the company may, at its option, give permission to exceed the determined maximum rate of use by a stated amount without increasing the estimated demand upon which the primary rating is based.

Meters.—Not over two (2) meters will be furnished by the company at its expense at any one contract location under this Schedule, unless installed for the company's convenience. Additional meters will be furnished at a rental of $2.50 per month each, for meters on which demands are determined and at a rental of $1 per month each for sub-meters. Where more than one meter is installed for the convenience of the customer, the consumption shall be billed separately for each meter and the demand and the primary rating determined separately for each meter.

Night Service.—For installations in which gas is chiefly used for such processes as require its consumption between the hours of 8 P.M. and 6 A.M., such as the processes used by bakers, the specified demand, or the demand upon which the primary rating is based, may be taken as one-half ($\frac{1}{2}$) of the maximum demand occurring between the above said hours, provided that the demand upon which the primary ruling is based shall not be less than the maximum demand during any other hour, and that the primary ruling shall not be reduced below 4,000 cubic feet per month.

Combination, Domestic and General Service.—For a customer using domestic service on the same meter with service for other uses than are provided for under the domestic Schedule D, the primary rating will be taken as the sum of the domestic primary rating under Schedule D, and of the primary rating under this Schedule C.

Termination.—When the customer has used the company's service at the contract premises for over one year, the contract may be terminated at any time after ten days' written notice from either party to the other. Upon proper notice of removal, the contract will be terminated.

SCHEDULE D—RATES FOR DOMESTIC SERVICE.

Gas for domestic use will be sold under this schedule to any domestic customer of this company who has signed an agreement for the service under the usual terms and conditions now or hereafter in force. This schedule will become effective on all consumption after the regular meter reading taken in February, 1916.

Primary Rates—85 cents gross per 1,000 cubic feet, 75 cents net when bills are paid on or before the last discount day.

Secondary Rates—When the customer's use of gas is in excess of the amount hereinafter specified under primary rating, the additional consumption so used will be at the rate of 45 cents gross per 1,000 cubic feet, 35 cents net when bills are paid on or before the last discount day. This secondary rate will be applied only where the said additional service is supplied through the regular house meter furnished for all consumption, and only to the consumption in excess of the estimated ordinary use of the consumer, which ordinary use will be designated the primary rating.

Primary Rating—The primary rating for new customers and for present customers, at new locations, will be determined as follows, it being understood that all ordinary rooms, such as living rooms, dining rooms, kitchens, bedrooms, servants' quarters, bathrooms and laundries, will be included in the list of rooms, but that cellars, closets, pantries and storerooms will not be included:

Private houses of	6	rooms or less	4,000	cubic feet	per	month
" "	7	"	5,000	"	"	
" "	8	"	6,000	"	"	
" "	9	"	7,000	"	"	
" "	10	"	8,000	"	"	
" "	11	"	9,000	"	"	
" "	12	"	10,000	"	"	

with an excess of 1,000 cubic feet per room for each room over 12.

Individual apartments will be rated on the same basis as private houses. Boarding houses and rooming houses shall be taken at 1,000 cubic feet per room per month.

In putting this schedule into general effect for all domestic customers on the lines of the company at the time of the said February meter readings, the primary rating will be taken in each case as the number thousands of cubic feet per month that is nearest to the maximum consumption by the customer in any month during the preceding 12 months at the same premises, and such maximum consumption will control the determination of the primary rating for all such customers so long as they continue at their present premises. When the customer has occupied a premises for less than eight months, the company shall have the right to determine the primary rating in accordance with the schedule herein. The primary rating shall in no event be taken at less than 4,000 cubic feet per month for any of the classes of customers specified herein, and where the customer's maximum consumption has been less than 4,000 cubic feet per month, his primary rating shall be taken at 4,000 cubic feet and the secondary rate shall apply for all consumption in excess thereof.

SCHEDULE E—NON-CONTRACT GENERAL GAS RATES.

Gas for general use will be sold under the following rate schedule to customers of this company, under the usual terms and conditions now or hereafter in force. This schedule was filed with the Public Service Commission of Maryland, effective January 1, 1916, and is now refiled under the aforementioned letter designation for the purpose of establishing its classification with reference to Schedule D filed herewith.

The gross price of gas for private consumers is eighty-five (85) cents per 1,000 cubic feet, with the following discounts:

For consumption of less than 50,000 cubic feet per month, a discount of ten (10) cents per 1,000, making the net rate seventy-five (75) cents.

For consumption of from 50,000, to 100,000 cubic feet per month, a discount of fifteen (15) cents per 1,000, making the net rate seventy (70) cents.

For consumption of 100,000 cubic feet or over per month, a discount of twenty (20) cents per 1,000, making the net rate sixty-five (65) cents.

These discounts are allowed provided the bill is paid at the office of the company within ten days from the date of reading of the meter, consumption to be registered on not more than two meters in one building.

SCHEDULE K—INDUSTRIAL GAS RATES, GENERAL SERVICE.

Gas for industrial uses, in specified location, will be sold under this schedule to any customer who has signed an agreement for permanent gas service for a term of at least three (3) years, embodying the terms and conditions of the company. No maintenance or supplies of any kind will be furnished by the company under this schedule. Agreements will continue in force for repeating periods of one (1) year each, unless terminated by the customer or the company by thirty (30) days' written notice before the termination of the original term, or the termination of any year thereafter.

FIXED COSTS.

A price of $204 per year, payable in monthly installments of $17, will be charged for the first 300 cubic feet of demand or fraction thereof.

Reduction.—A price of $48 per year per 100 cubic feet of demand, payable in equal monthly installments of $4 will be charged for that part of the demand that is in excess of 300 cubic feet.

These prices are to cover the company's fixed investment and operating charges in establishing service and standing ready to serve, and do not include the supply of gas.

RUNNING COSTS.

A price of 45 cents gross per 1,000 cubic feet, 35 cents net when bills are paid on or before the last discount day, will be charged for all gas supplied under this schedule, up to and including 1,000,000 cubic feet per month.

Reductions.—A price of 40 cents gross per 1,000 cubic feet, 30 cents net, will be charged for all gas supplied under this schedule exceeding 1,000,000 cubic feet per month.

Prompt Payment Discount.—The net prices above specified result from and depend upon a discount of 10 cents per 1,000 cubic feet from the specified gross prices given only for payment of bills within 10 days from the date of the reading of the meter.

Demand.—The demand is the maximum rate of use and is defined as the greatest number of cubic feet used in any one hour, and shall be specified in the contract. The specified demand shall be subject to revision by actual measurement of the customer's maximum's hour's use by suitable instruments furnished by the company. The demand having been thus established, shall not be substantially decreased during the term of the contract, but shall be increased in accordance with and for all billing after any increase in maximum use which may from time to time occur. Upon extraordinary occasions for a certain limited period, the company may, at its option, give permission to exceed the determined maximum rate of use by a stated amount without increasing the established demand upon which charges are based.

Non-Peak Service.—For installations in which the use of gas is considerably less between the hours of 5 P.M. and 7 P.M., during the period from October 1st to the succeeding March 1st, in each year, than at other times, the specified demand or the demand upon which the rate is based, may be taken as the measured rate of use occurring during any hour between the said hours in the said winter months, provided that the demand shall in no event be taken as less than one-half (½) of the maximum measured rate of use at any other time, the use under such conditions being classified as "non-peak."

Meters.—Not over two (2) meters will be furnished by the company at its expense at any one contract location under this schedule, unless installed for the company's convenience. Additional meters will be furnished at a rental of $2.50 per month each, for meters on which demands are determined and at a rental of $1 per month each for sub-meters. All meters referred to herein are of the standard type and sizes of gas meter and recording meter heretofore in general use; should the conditions in any instance call for different standards the company shall have the right to revise its fixed code and its meter charges specified herein accordingly.

Collective Application.—This schedule will apply to one contract location only. Where one person, firm or corporation is engaged in commercial or industrial business at more than one location, one contract may be made under this schedule for the supply of gas to the said several contract locations for a term of not less than five (5) years, under the following conditions:

The fixed charges for each location shall be based solely and individually upon the separate demands of said locations; and the running costs for all locations shall be based upon the aggregate gas consumption of all locations covered by the contract. One bill shall be rendered monthly, based upon the meter readings taken at approximate monthly intervals on such days each month as the company may elect.

Change of Rate.—In case the schedule upon which any contract is based should be modified to give any customer a lower rate for like service under like conditions during the period of said contract, the customer using service under said contract shall be given the full advantage of such modification from the date of putting such modification into effect for any service.

GENERAL INFORMATION IN REGARD TO STANDARD PRACTICE IN THE APPLICATION OF GAS RATE SCHEDULES.

Discount.—A discount of ten (10) cents per thousand cubic feet from the gross price of gas, to produce the net price, is allowed provided the bill is paid at the office of the company within ten days from the date of reading of meter, consumption to be registered on not more than two meters in one building.

Use of Two or More Meters.—Not over two (2) meters will be furnished by the company at its expense at any one contract location, unless installed for the company's convenience. Additional meters will be furnished at a rental of $2.50 per month each, for meters on which demands are determined and at a rental of $1 per month each for sub-meters. Where more than one meter is installed for the convenience of the customer, the consumption shall be billed separately for each meter and the demand and the primary rating determined separately for each meter.

Application of the Maximum Month's Basis of Rating.—All domestic customers of the company of over seven months' standing, prior to January 1st, 1916, will have primary ratings applied automatically by the company at the time of the regular February, 1916 billing, and will receive written notice thereof, in connection with the bills rendered for the said February meter readings, provided that the maximum month's consumption within the preceding year reaches at least 3,000 cubic feet, which is within 1,000 cubic feet of the minimum primary rating of 4,000.

Residences with Office or Store.—When part of a private residence is used as a professional office or salesroom, as a minor feature of the premises, without store-front, all service being supplied through the regular house meter, the Domestic Schedule D will be applied to the entire service.

When the residence is in a residential district and has a store-front on first floor, supplied through one meter only, customers of over seven months' standing prior to January 1st, 1916 will be supplied under Schedule D on the basis of the last year's maximum month's consumption, in accordance with the application of this schedule to domestic customers; but when in the new customers class, the primary rating will be taken on the basis of the total number of rooms, including the store, which will be rated as one room for each 500 square feet of floor area, or for any fraction thereof.

When a combination residence and place of business, supplied through one meter, uses gas for general or industrial purposes other than for lighting and room heating, the primary rating will be taken as the sum of the domestic primary rating under Schedule D and of the primary rating under Schedule C for general service, or of Schedule K for industrial service.

When the office, salesroom, store or place of business is supplied through separate meter, the Domestic Schedule D will not apply to the said separate service, but the Yearly Contract General Gas Rate Schedule C, or the Industrial Schedule K will apply.

Private Garages.—A private garage located on the same lot with a residence, when supplied through the same meter, shall be included in the primary rating for residence and supplied under Schedule D.

When a private garage in any location is supplied through a separate meter it shall be classed as domestic service, to be supplied under the Domestic Schedule D, but shall be billed separately with separate minimum the primary rating.

All rooms in the garage are to be counted in the determination of primary rating.

Public garages will not be served under Schedule D for domestic service.

Domestic Room Basis.—The number of rooms is determined upon the ordinary real estate rating. As stated in the schedule, it includes all ordinary rooms and bathrooms, but excludes cellars, closets, pantries, and storerooms. There are also excluded unfinished attics, porches, and hallways or alcoves not ordinarily considered as rooms and not used in lieu of regular rooms. All finished and regular rooms, whether using gas or not and whether habitually used by the occupant or not, shall be included in the schedule list of rooms on which the primary rating is based.

Change of Rating Basis or Schedule.—Any customer may, upon application, have his primary rating changed from the maximum month's basis to the room basis under Schedule D.

The maximum month's basis is the automatic rating for customers of record at the time of introduction of this schedule, intended to put the secondary rate at the customer's immediate disposal in connection with existing conditions. The room basis is the method of standardizing rates for new customers and old customers alike, being applied necessarily to new customers, and at their option to old customers.

This option will be particularly advantageous to customers having had extraordinarily high consumption in the past, owing to use beyond the normal. The company is without the necessary information to enable it to apply these room ratings to old customers without their co-operation.

Any customer may, upon application, change from any one gas schedule to any other, to obtain the most advantageous rate, provided that the change is a permanent one and provided that the customer's use complies with the conditions specified in the respective schedules.

Any such changes in rating under Schedule D, or changes from one schedule to another, shall be effective from the last regular meter reading date.

Apartment Houses.—Each apartment will be rated on the same basis as a private house, as will janitor's quarters when metered separately.

Public service, as for hall lighting, water heating, cooking and public dining rooms, when metered separately from individual apartments, shall not be supplied under the Domestic Schedule D.

Apartment houses where the landlord or agent is billed for the entire service consumed in the building on one meter, shall be classed as general and not domestic. Where separate meters are installed they shall be billed individually with their own separate primary ratings under Schedule D.

Large Boarding Houses.—Any boarding house or rooming house having more than 10 rooms to let, will be classed as a hotel, and will not be served under Schedule D.

Application of Rates to Large Consumption and Long Hour Service for General Use.—Any general customer using over 50,000 cubic feet per month will usually be supplied more advantageously under the industrial Schedule K, and where the conditions of use are such as to warrant the application of that schedule, it is available to such customers on application, or will be proposed by the company's representatives. For small customers, using less than 300 cubic feet per hour maximum rate of use, and where the use of gas covers a period of several hours each day, the yearly contract general Schedule G will be of advantage to the enstomer, but there the customer's use in any month may reach 50,000 cubic feet or over, and either of the aforesaid schedules will produce a higher average rate than the Non-Central General Gas Rate Schedule E, this latter schedule should be selected. It is suggested that all possible attention be given by customers to adopting such methods of use of the gas service as will spread the use over as many hours of the day as possible, and it is such use that is intended to be encouraged by the company's methods of applying the 35-cent rate for excess service.

General Uses.—All customers not classified under Domestic Schedule D, or Industrial Schedule K, will be served only under Schedule E, or, at their option, under Schedule C.

Rating for Customers Using Gas for Air Heating at the Time Schedules are Made Effective.—Domectic customers using gas heating systems to a material extent at the time of the introduction of Schedule D, will be served under that schedule, with a primary rating based upon the number of rooms according to the schedule.

Entry to Premises.—As a condition of applying schedules that take the number of rooms, demand, or similar billing factors into consideration, permission must be given to the company to enter the customer's premises at all times for the purpose of determining the proper basis of billing. Permission shall likewise be given for the purpose of inspecting and keeping in repair, or removing any or all of the company's apparatus used in connection with the supply of gas.

The contract shall not be assigned by the customer without the prior written consent of the company.

Schedule K.—The term "specified location," in the opening paragraph of Schedule K, refers to a single location specified in the contract, that is, to a single premises occupied by the customer, or to adjoining premises occupied by the customer for the same purpose, in which case the service may have been supplied through independent service and meters, prior to the application of Schedule K.

Rules and Regulations.—All service furnished by the company is subject to the reasonable rules and regulations in addition to those herein referred to.

Investigating a Complaint of Explosions of Leaking Gas.

By Albert Dunbar.

On Monday, February 5, 1912, about 9 P.M., the Police Department of Boston, Mass., telephoned to the Boston Consolidated Gas Company's office, that explosions of gas were taking place through the ice and snow on a certain street. As superintendent, I immediately went to investigate the trouble.

The street in question is 120 feet wide with a double line of car tracks in a unpaved space in the centre, and a roadway on either side. In one roadway there was a 6" and a 24" gas main, also conduits of the Edison Electric Illuminating Co., containing both high and low tension electric cables, and other conduits containing cables of the Boston Elevated Railroad Co. The ground was frozen to a depth of about 4 feet. By inquiry at a house in the vicinity, I learned just where the explosions had taken place. The lady who gave me the information said that the explosions came up through the ice and show at irregular intervals, not only in the street, but also in her back yard. She said that sparks and balls of fire jumped up about 4 feet high from the ground. I knew that this could not be caused by a defective gas pipe, and I called an electrical engineer into consultation. He watched the street surface carefully, while I went to the nearest telephone and summoned the night emergency men of the Edison Electric Illuminating Co. I had not seen any of the explosions myself, but while I was telephoning I heard a loud report, and, rushing to the street, saw a cloud of smoke roll away. The electrical engineer witnessed the sparks, which he described as a ball of fire shooting up through the ice and snow from the frozen ground. He said that it was without question caused by a short circuit on some of the underground electric cables. As all this took place directly over our 24" gas main, I became somewhat alarmed, and summoned the night emergency gang of the Boston Elevated Railroad. Within 30 minutes of the time I telephoned, representatives of both the Edison Co., and the Elevated Co. had arrived and both denied responsibility for the trouble; and as superintendent for the gas company, I was positive that our main could not cause the trouble. People living in the vicinity were considerably excited, and afraid of being blown up, refused to go to bed; something had to be done. At this point I was warned by the electrical engineer to stand away, as short circuits on high tension cables were very dangerous.

We stood around for about an hour, awaiting further explosions, during which time the night emergency gang of the elevated railroad continued to examine their manholes, but no further explosions took place. I then looked the street surface over carefully, and could detect small holes, about one inch in diameter, in the ice, where the explosion took place. Each hole appeared to be wet, some even contained liquid, and quite resembled the holes made by placing rock salt on an icy roadway. At that time, one of the neighbors made the remark that "there was some technology students living opposite" to where the explosions occurred.

The thought occurred to me that if metallic calcium is thrown into water, the action is so violent that the gases formed ignite and explode. In the case of metallic sodium, where the amount of water present is not sufficient for complete hydration, similar explosions took place. If metallic sodium is placed on ice, the ice will not melt fast enough to satisfy the reaction, and, as soon as part of the ice melts, an explosion results.

A bottle was procured, and by means of a spoon, a few drops of the liquid was scraped up from each of the several holes in the street. The solution had an oily feeling and a strong caustic taste. A hurried analysis showed that it was probably hydrate of sodium, and a futher examination of the holes in the street showed them to be merely surface effects, about an inch deep, and not of volcanic origin, as previously supposed.

I returned home and went to bed. The next day I called at the home of one of the students, and asked to see him. I told him that I represented the gas company, and asked him if he was a technology student. He said that he was, and was studying chemistry. I remarked that he was then in a position to obtain metallic sodium, and he said he was, "as it was cheap stuff, worth only about a dollar a pound." I told him of our trouble of the night before; told him of my investigation, and that as a technology graduate I knew that some student, who was in a position to obtain metallic sodium, had thrown it in small pieces into the street, along the line of our gas mains; that I would promise to make no trouble for the guilty party if they would confess, and if he could give me any information, I would accept it in a friendly way.

"Well," he said, "all there was to it, is that a classmate of mine was over here last night and we cut up some metallic sodium into cubes about ¼" in size, and threw them out of the window to see the fun."

I thanked him for the final chapter he had added to the story, explaining the seriousness of the matter to us, and assured him that any repetition of such acts would be promptly reported to the authorities.

Compressibility of Natural Gas.

Technical Paper No. 131, "The Compressibility of Natural Gas at Pressures up to 35.5 Atmospheres," by G. A. Burrell and I. W. Robertson, just issued by the Bureau of Mines, describes experiments that disclose a matter of great importance to the natural gas industry; namely, that in measuring natural gases at high pressures, a mistake, of as much as 10% or more of the total gas measured, has been and is being made.

For years the industry has accepted Boyle's law as true in measuring natural gas, that the product of the pressure and the volume of the gas is a constant at all pressures, or that the volume of a gas varies inversely as the presure applied to it. The law may be accepted as true only for pressures close to atmospheric, and neglect of the error has resulted in enormous miscalculations in natural gas measurements. Billions or cubic feet of natural gas are measured at pressures greater than atmospheric, 300 pounds per square inch or greater being common. At 100 pounds per square inch an error of 3% was found; at 200 pounds, 6%; at 375 pounds, 11%, and at 520 pounds, 15%. Natural gas at these pressures is more compressible than an ideal gas (for which Boyle's law holds).

An example will make the matter clear. If 50,000,000 cubic feet of natural gas are measured per day at a pressure of 200 pounds per square inch, and no correction applied for the deviation from Boyle's law, an error of about 3,000,000 cubic feet is made. Instead of the measured amount being 50,000,000 cubic feet, as supposed, it is actually 53,000,000 cubic feet.

Two More Doherty Cadet Schools.

The school of Gas and Electric Practice operated by Henry L. Doherty & Company in connection with the Denver Gas & Electric Light Company, has long been known as the premier finishing school for collegiate engineers; and announcement is made that two additional schools will be opened. One of these will be located at Toledo and the other at Bartlesville, Okla. It is the practice of Henry L. Doherty & Company to secure the pick of the graduate engineers from the leading colleges and have them take a 2-years course at the cadet school. During this course, they are taught everything in an electrical and gas way from practical standpoints, including the selling end, and are then placed among the different Doherty properties according to their merit. Twenty new cadets will be engaged to join the Denver school, where about 15 men are now attending. Secretary N. J. Dicks will remain in charge.

Thirty cadets will be enrolled at the Toledo school, to be operated in connection with the Toledo Railways and Light Co., and who will study electricity and have the benefits of street railway instruction, which Denver does not furnish. For the school at Bartlesville, 10 cadets will be engaged, under the direction of Alfred J. Diescher, who is in charge of natural gas and oil operations of the Doherty properties in the southwest. These cadets will specialize in natural gas and oil.

New Methods and Appliances.

COST OF WELDED PIPE JOINTS.—The Peoples Gas Light and Coke Company, Chicago, gives the following costs for welded pipe joints, not including ditching, laying, back filling and repaving costs:

Number of welders necessary on gang laying 4" pipes, 1 welder and 1 helper for gang of 25 men; for 6" pipe, 2 welders and 2 helpers for gang of 40 men; for 8" inch pipe, 2 welders and 2 helpers for gang of 40 men; for 12" pipe, 5 welders and 5 helpers for a gang of 90 men.

The welders being the highest priced men on the gang, care was taken to keep them on actual welding work as many hours a day as possible, and in order to do this, a helper, at $2 a day, was assigned each welder.

It is the duty of these helpers to watch the gauges on the gas tanks and determine when tanks should be changed; to bring up new tanks; to have tanks and tools in position so that changes can be made with the least possible loss of time to the welders; and to line the pipe and assist in turning it in proper position for welding.

To obtain the best results it was found that the torch heads should be selected to suit the size and thickness of pipe, the largest head possible being used. With the proper selection of the head, the welder is forced to work up to the speed of the head, as it is almost impossible to slow down with a given flame.

The welding material used was ¼" Norway iron.

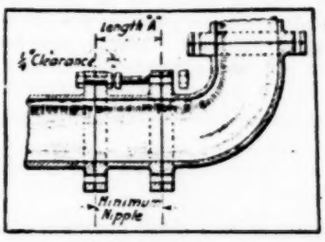
Aside from the welders and the helpers, the duties of the other men on the gang are exactly the same as those of the laborers on an ordinary gang, laying cast-iron or steel pipe.

Cost of Making Joints.

Size.	Cost.
4"	$0.71
6"	1.15
8"	1.35
10"	2.13
12"	2.85
16"	3.52

These figures include the cost of oxygen, acetylene and filling material, and of labor; the labor figured at $3 per man per nine-hour day.

MINIMUM LENGTH OF PIPE NIPPLES.—In laying out a line of flanged pipe it is important to know the minimum length nipples that can be used for the different sizes of pipe. Such data are given in the accompanying table, the minimum length being that allowed for the withdrawing of bolts. The length, *A*, is determined by muliiplying the flange thickness by four, the thickness of the bolt head by two, and the thickness of the nut by one; and adding a clearance of ¼".



Limitations to the Length of Nipples that can be used with flanged Pipe.

The thickness of flanges and the size of bolts were taken from the American standard schedule, and the thickness of bolt heads are those given in manufacturers' standard lists, three-fourths the diameter of the bolt. The thickness of the nuts was taken as equal to the diameter of the bolt.

Minimum Length of Pipe Nipples.

Size of Pipe, Inches.	Length "A."		Size of Pipe, Inches.	Length "A."	
	Standard. Inches.	Extra Heavy. Inches.		Standard. Inches.	Extra Heavy. Inches.
2	4 3/16	5 3/16	10	7 3/16	10 1/4
2 1/2	4 9/16	6 1/4	12	7 7/16	11 1/16
3	4 13/16	6 5/16	14	8 1/4	11 9/16
3 1/2	5 1/16	6 7/16	15	8 1/4	12 1/16
4	5 9/16	7 1/16	16	8 1/2	12 3/16
5	5 7/16	7 5/16	18	9 3/16	12 7/16
6	6 1/16	7 7/16	20	9 13/16	13 11/16
7	6 3/16	8 7/16	22	10 7/16	14 1/2
8	6 5/16	8 13/16	24	10 7/16	15 3/16

Items of Interest from Various Localities.

A. P. LATHROP, president of the American Light and Traction Company recently gave a short talk before the Grand Rapids Gas Light Club, following the efficiency engineer, A. J. Koehler, who had given a half hour talk on the general subject of efficiency. Mr. Lathrop urged the 30 young men employees of his company to heed the good advice of Mr. Koehler, asserting that efficiency promotes better and more business, and that more business means better conditions for the employes. John T. Young, the general manager of the Grand Rapids Gas Light Company, spoke briefly. George D. Kingwell, president of the club, announced a meeting in two weeks when Dr. C. Warnhuis will give a talk on first aid. There are now 90 members in the club.

THE Western United Gas and Electric Company, in postal cards sent to all Aurora (Ill,) consumers, asks a vote on the plan to adopt a new system of meter reading. At present all meters are read at about the same time, and when bills are paid on or before the 15th of the month a rebate is allowed. The new plan is to divide the city into districts and to have a fixed time when meters will be read, each district having a different time for paying bills. Under the proposed plan there will be less crowding at the office of the company and clerks will be able to give better service. On the same postals the company asks that the consumers write whatever complaints they have on the service as well, as suggestions for improvements.

L. F. BLYLER, new business manager of the Minneapolis Gas Light Company, has been elected chairman of the Civic and Commerce Association's Committee on Publicity and Conventions.

As a result of a recent inspection of the Citizens Gas, Electric and Heating Co., Mt. Vernon, Ill., the Illinois Public Utility Commission wrote General Manager H. E. Brandli this comment: "We are glad to note from our engineer's report that your complaints seem to be well handled, your meter records are in good shape, your meter testing equipment is good, your pressure regulation is satisfactory, and that your service is giving general satisfaction."

MR. GEO. W. ALLEN, of the Consumers Gas Company, Toronto, Canada, gave his lecture on "The History of Manufacture and Uses of Gas," before a public gathering in the Normal School Hall, in Ottawa, on February 11th.

THE officers of the Guild of Gas Managers, of New England, for 1916 are as follows: President, S. J. Fowler; Vice-President, D. D. Barnum; Treasurer, W. F. Norton; Secretary, H. K. Morrison.

THE new manager of the Crookston (Minn.) Gas Company, Mr. K. L. Spiering, has instituted semi-monthly meetings of the employees of the company, at which matters will be discussed bearing upon bettering the service to consumers. The Crookston plant is owned by the Gas Machinery Company, Cleveland, O.

THE Fitchburg (Mass.) Gas and Electric Company, though a combination company, is featuring gas as "the most inexpensive of all illuminants or fuels," in its newspaper advertisements. During the month of February the company conducted a special house-piping campaign, making a special price of $2.45 for concealed outlets, and $1.95 for exposed outlets, these being about 50 cents below regular prices. A 10% discount on fixtures prevails during February. Payments on the installation plan are allowed on installations. The company has made large gains in its gas business.

MR. W. H. WEST, manager of the Westbrook and South Portland Gas Co., Westbrook, Me., has accepted a position with the General Gas Light Co., as their New England representative.

WHEN the West Chapman Bridge, in Santa Ana, Cal., was carraied away by the late flood, the Southern Counties Gas Company connected the 3" gas main supplying the Orange, Santa Ana and Tustin gas systems, with the supply main from the Orange county field by a 100-foot section of fire house. A light rope was thrown across the gap and a team of horses drew a heavy cable across, by which the hose was supported.

A receiver has been appointed for the Syracuse (N. Y.) and Suburban Gas Company on petition of a creditor, who stated that a settlement is possible so that the company may not have to be adjudicated bankrupt. The liabilities are placed at over $65,000, while the assets are $45,762. The officers of the company admit the insolvency of the company and express their willingness that it be adjudicated bankrupt. The company has been doing an increasing business buying gas from the Syracuse Lighting Company for 70 cents and selling it at $1.40.

A CAMPAIGN on industrial fuel appliances, conducted during January, by the Denver (Col.) Gas and Electric Company, operated by Henry L. Doherty & Company, sold 113 appliances, costing $2,680.23.

Miscellaneous appliances	5
Hotel and restaurant ranges	16
Bake ovens	4
Johnson torches	3
Candy furnaces	1
Galvanized boilers	2
Auxiliary furnace heaters	3
Cake griddles	2
Batch warmers	1
Water heaters (all circulating heaters)	9
Augmore regulators (thermostats)	5
Special burners	3
Coffee urns (two Kellum)	3
Hot plates	9
Gas forges	2
Steam tables	1
Waffle irons (including 3-hole special)	12
China kilns	1
Oyster stewer	1
Special furnace	1
Water still	1
Office heaters	4
Bain Marie (special steam table)	1
Butchers furnace	1
Cyclone burners	21
Rulu lighters	1
Total	113

In addition the company holds uncompleted sales orders for more than $500, and a number of excellent prospects were secured, including an all-gas kitchen proposition for one of the largest restaurants.

THE Des Moines (Ia.) Gas Company makes a "frost charge" of $5 for installing services during the winter. They say: "We like to have all the work done when there is no frost in the ground. We advise builders to have it done then. If they come to us in the winter, we tell them we don't want to do the work at that season, but that we will do it if they pay us an extra $5." Eskil Carlson, city solicitor, says that the charge is legal, on the ground that to dig in the ground in the winter, is lawfully an "extraordinary burden."

THE Niagara Light, Heat and Power Company, of Tonawanda, N. Y. will make a number of improvements at the gas works on East Niagara street, including an addition 25 feet by 16 feet, for an ammonia concentration works. The entire gas works will be overhauled and one of the benches will be rebuilt at once.

THE Consolidated Gas Company, New York, the American Gas Company, Philadelphia, and the Consolidated Gas, Electric Light and Power Company of Baltimore, have contributed to a fund to be used by John Hopkins University in a laboratory investigation of coal tar dye manufacture.

AT the annual meeting of the Salem (Mass.) Gas Light Company, the year's reports were read and accepted, and Benjamin W. Sluman was elected clerk and treasurer. The reports showed the company to be in sound condition. The following directors were chosen: Henry A. Hale, George W. Grant, Charles R. Prichard, Andrew W. Rogers, John H. Smith, Sidney W. Winslow and Sidney W. Winslow, Jr. The directors will meet for organization the latter part of the month.

WALPOLE KALER and Lloyd T. Bailey have presented a petition to the city council of Columbia City, Ind., asking for a fifty-year-franchise to install and operate a plant which will require the expenditure of $70,000, if granted. Later the system will be extended to Churubusco, South Whitley and Larwill.

Formal notice that the 50-year franchise granted to the Alton (Ill.) Gas and Electric Co had been revoked by the City Council has been given. The company it is said may take the matter to the courts. The franchise was revoked because the company was working under a former 20-year franchise.

MR. E. C. HUDSON, superintendent of the gas department of the Tidewater Power Co., Wilmington, N. C., has been investigating the welding of pipe joints and installation of compressors, in conjunction with the extension of the mains of the company to Wrightsville Beach. Material is already arriving for the extension, and the actual work of laying pipe is expected to be commenced within two weeks.

A FORCE of 200 men probably will be required to take the inventory of the properties of the Peoples Gas Light and Coke Company, according to a report submitted to Chairman William L. O'Connell by the engineering department of the Illinois Public Utilities Commission. Ten men already are at work at the Ninety-sixth street station, and this force will be gradually increased, the inventory being made in sections. The engineers employed by the company, with whom the engineers of the commission will cooperate, are Henry I. Lea, William J. Hagenah, Sanderson & Porter, Sloan, Huddle, Feustal & Freeman, and William A. Baehr.

PRESIDENT CHARLES H. NETTLETON told the stockholders of the New Haven (Conn.) Gas Light Company, at their annual meeting, that the company had had a very prosperous year and that the sale of gas had increased 92,000,000 cubic feet over the year before. The sale of new gas appliances reached over 5,768 pieces. While the company has not made any important extensions of its pipe lines into new territory, there were 13½ miles of new mains laid. The directors elected are the same as last year: George D. Watrous, Charles H. Nettleton, A. Heaton Robertson, Winston J. Trowbridge, Frederick F. Brewster, Eli Whitney, James S. Hemingway, H. Stuart Hotchkiss, and James T. Moran. The officers re-elected are: President, Charles H. Nettleton; Vice-President, George D. Watrous, and Secretary and Treasurer, J. Arnold Norcross.

THE Boise (Ida.) Gas Light and Coke Company has filed a new rate with the Public Utility Commission for gas used in arc lights for industrial purposes. This rate is $1.10 per 1,000 cubic feet gross, with a rebate where a greater numder of feet is used.

ALONZO P. EWING, former Assistant General Manager of the Detroit City Gas Company, now Vice-President and General Manager of the new Highland Park State Bank, was guest of honor at a farewell banquet tendered by the new business department of the gas company, in the Board of Commerce building. He was presented with a gold watch, chain and knife. A. A. Treadway made the presentation.

THE proposition to reduce rates on gas for the next 5 years, made by the Peoples Gas Light and Coke Company of Chicago, is conditional upon the city permitting the change from a candle power to a heat unit basis. The gas company's offer is an amplification and definite fixing of a scale suggested some time ago, when the company offered to build a $14,000,000 coal gas plant on the West Side, if allowed to change the system of testing. The schedule of prices proposed is as follows:

	1916.	1917.	1918.	1919.	1920.
First 25,000 feet.....	.78	.78	.77	.75	.75
Second 25,000 feet....	.70	.70	.68	.65	.65
All over 50,000 feet...	.50	.50	.50	.50	.50
Minimum bill.....	.75	.75	.75	.75	.75

The offer says: "The requirement of a minimum bill is in line with the modern practice of utilities commissions. The company is prepared to demonstrate the propriety and fairness of such a requirement. The method of charging for gas heretofore followed has militated against its use for manufacturing and industrial purposes, and has consequently tended to so restrict the sales that the public has not derived the benefit in reduced cost in all gas sold that must come with an increased average consumption per customer. It is, therefore, desired to develop the use of gas for manufacturing and industrial purposes."

THE Old Colony Gas Company, which supplies Braintree, Weymouth, Rockland, Abington, Hingham and Whitmass, Mass., has weekly in the local papers a little batch of reading notices under the heading "Old Colony Gas Items." Here is one under date of Feb. 11th: "The Welsbach Lighting Company is exhibiting eight gas street lamps on South avenue, Whitman. Two of these lights are of 125-candle power, six of 85-candle power. Much comment is being heard from the townspeople regarding these lights and their soft, well-diffused rays of light. They are being burned all night which makes it a novel demonstration as the town has not been accustomed to all night lighting."

Utilities Commission News.

PRIVATE COMPANIES PROGRESSIVE.—An opinion has been filed by the Pennsylvania Commission overruling the objections filed by the borough of Lansdale to the granting of a certificate of public convenience to the Towamensing Electric Company to operate in the township of that name in Montgomery County, and the charter application will be sent to the Governor. The decision was rendered in a case that has attracted general attention because of the effect it may have in other parts of the State. The borough furnishes power to consumers living outside of its limits and declared through its representatives that it was furnishing enough to meet the demand.

The opinion says that the borough claims to have the right to furnish power outside of its corporate limits, under the borough code, but that this question need not be determined now. The commission declares that "it could not be safely maintained when service is furnished from the surplus current of a municipal plant that the same diligent effort will be made to develop the territory and install facilities within the reach of everyone desiring service, as would be the case with a private company, since the latter is always more or less engaged in seeking ways and means of pushing forward its plant operations."

MAIN EXTENSION CONTRACTS NOT FAIR.—The Missouri Commission has ruled against the plans of the St. Joseph Gas Company to make consumers pay for extensions of gas mains and get their money back in installments of gas within three years, or not at all. The commission holds such contracts are unjust and cannot be maintained. When the consumers paid for the mains they gave the company a title thereto, and agreed if they could use half the cost thereof in gas over a period of three years, they would be entitled to it. The city filed a complaint, alleging that about one-third of the money was not returned to consumers. Out of one lot of extensions which cost $23,361.75, the sum of $4,155.77 was forfeited to the company.

The ruling of the commission, which was prepared by Chairman Atkinson, holds that money expended for the benefit of the company in this way must be considered as a loan and bear 6% interest until refunded in full.

MASSACHUSETTS COMPANIES ASKED TO REPORT FIRE HAZARDS.—Gas companies in the Metropolitan Fire Prevention District, including Boston, Cambridge, Chelsea, Lynn, Everett, Malden, Medford, Melrose, Newton, Quincy, Waltham, Arlington, Brookline, Lexington, Watertown and other Massachusetts towns, have been asked by the Fire Commissioner to instruct their installing force and inspectors to report conditions liable to cause fires—such as nearness of gas jets to curtains, gas stoves and heaters too near wood work, and meters in hazardous locations—with a view to the correction of such menaces, either through the company's office or that of the Commissioner. It is hoped that the many small fires reported to have originated from the causes mentioned may be considerably diminished by such co-operation.

Financial Notes.

THE reduction in the Peoples Gas dividend rate from 8% to 6% per annum, beginning with the payment on May 25, reduces dividend requirements for the current year from $3,075,994 to $2,502,500. Reduction of the dividend strengthens, at least sentimentally, the company's position in its fight with the city of Chicago over rates and its attempt to have the gas standard changed from 22-candle to a heat unit basis. For a long time there has been too close a margin between percentage earnings on the company's outstanding stock and dividends paid. Surplus after dividends in each year since 1909 has been as follows:

Dec. 31	Sur. for Divs.	P.C. on Stock	P.C. Paid	Deprec.	Surplus
1915.....	$3,228,966	8.39	8	$1,292,140	$152,972
1914	3,292,468	8.55	8	1,106,436	327,694
1913	2,887,064	7.50	7¼	1,293,721	349,564
1912.....	2,639,750	7.54	7	1,269,961	189,750
1911.....	3,122,581	8.93	7	1,175,647	672,581
1910	3,154,333	9.01	7	1,068,878	704,332

Management of Peoples Gas, prior to Commonwealth Edison control, had a rate fight on its hands continually but was able to keep from reducing dividends. The present management has determined to carry the fight to the enemy's camp. In defense of its rate before the Illinois Public Utilities Commission, the company is having independent determination of the fair value of the property made by engineers of national reputation. The desire of the management is to set at rest for all time the relation between the present value of the company's property and its issued securities. Once this question is settled it should not be difficult for representatives of the public and of the company to agree on a fair rate for gas. Litigation over the gas rate charged from Aug. 1, 1912, to Aug. 1, 1916, was not a factor in the minds of the directors when they decided to reduce the dividend rate from 2% to 1½% quarterly. As Samuel Insull said, the matter is in the courts, will drag along for years, and has no bearing on the present situation. Apart from the relation of the dividend reduction to the rates to be settled upon for the five-year period beginning August 1, next, the chief consideration was Peoples Gas need of new capital to change the manufacture of gas to the coal process from the water process,with its requirements of large amounts of gas oil, which rose in price alarmingly in 1915. The company faces an expenditure of $14,000,000 in three years, a large part of which will come in the near future. This money can be obtained on a good basis, provided the margin between earnings and dividends is increased, and provided the rate situation is settled on an equitable basis. The Company has more than $5,000,000 free cash and surplus and reserves of nearly $20,000,000.

THE CITIES SERVICE COMPANY earning statement shows:

	12 Mos. Ending Jan. 31, 1916.	12 Mos. Ending Jan. 31, 1915.
Gross earnings.....	$4,717,443.55	$3,945,594.36
Expense	178,143.02	126,250.51
Net earnings.....	4,539,300.53	3,819,343.85
Interest on notes.....	490,000.00	431,666.66
	4,049,300.53	3,387,677.19
Interest on debentures.....	2,132.50	
Net to stock.....	4,047,168.03	
Div. pfd. stock paid and accd.....	1,606,712.85	1,629, 994.00
Net to common stock.....	2,440,455.18	1,757.683,19
Divs. to common stock.....		392,519.68
Net to surplus and reserve.....	2,440,455,18	1,365,163.51
Contingent fund.....	296,344.16	
Surplus reserve.....	600,017.94	
Surplus.	4,194,706.42	
Total contingent fund, surplus and reserve.....	5,091,068.52	
Ratio "Net to Stock" to pfd. divs. paid and Accd.....	251.89%	207.83%
Per cent earnings on com. stock	16.26%	11.33%
Prefered stock outstanding.....	$31,810,362.00	
Common " "	17,250,564.00	
Gross earnings of subsidiary properties for 12 months ending Dec. 31, 1915.....	$22,656,079.00	

THE report of the Comptroller of Currency, for the year ended June 30, 1915, shows that the largest increase in percentage of security holdings by banks of the United States during the year was in those of public utilities. The increase in percentage was 30.7, while the increase in gross was $80,000,000 or the second largest gross increase. Savings banks show the largest increase in holdings of public service bonds, other than those of railroads. National banks increased their holdings of public utility securities by only $2,000,000. State banks increased their holdings of public utility issues by about $16,000,000. On June 23, 1915, there were held by banks of the United States, public utility securities to the total value of $663,900,000, compared with $583,900,000 on June 30, 1914.

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